

# Investigation of calcifications in breast tissue using EXAFS and XRF

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EXAFS studies have recently been conducted on calcifications in breast tissue as part of an ongoing study in the connection of calcifications to breast cancer. It has been determined that the chemical composition of calcifications is related to the development of benign or malignant breast disease [1, 2]. We are interested in improving the understanding of this connection. For our initial experiments, calcifications were removed from non-cancerous breast tissue and scanned using the EXAFS setup on beamline 10.3.2. EXAFS spectra were collected from several regions in the samples and compared to the standard spectra of hydroxy apatite, calcium oxalate, monetite, and brushite. Figure 1 is an example of our initial results. The XANES spectra from four regions on one sample are compared with hydroxy apatite. It is clear that region A most closely resembles the hydroxy apatite spectrum. The other regions display other features in the spectra that are not present in hydroxy apatite and have not yet been accounted for in the other standards. The presence of other compounds in the calcification is a possibility, though it is not clear what role they play.

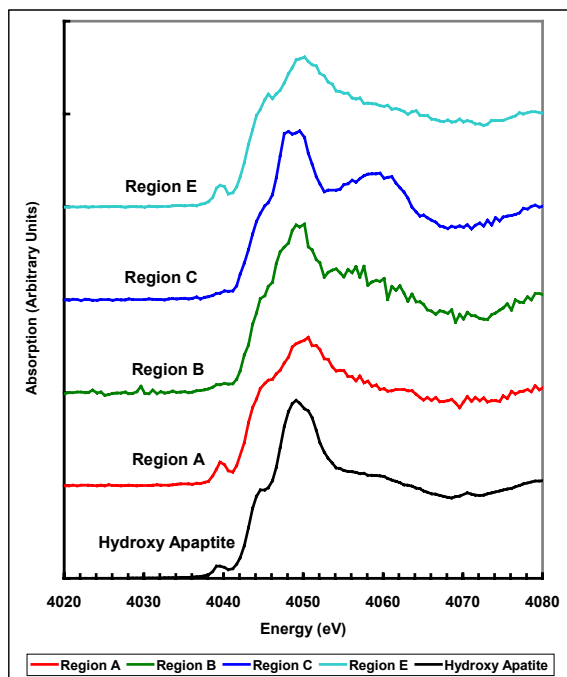


Figure 1. XANES spectra of four regions on a calcification sample from breast tissue, taken at the Ca edge. The four regions are compared to the XANES spectrum of hydroxy apatite

Additionally, XRF studies have been conducted on these tissue samples to investigate the elemental distribution in the calcifications. These studies were run concurrently on beamline 10.3.1. Figure 2 is a photo of one of the samples with the location of the calcification indicated by the dashed lines. Figure 3a is a map of the calcium concentration of this sample. The highest

concentration occurs in the region of the calcification. Other elements were present in the sample, and figure 3b shows the zinc concentration. There is a clear correlation between the calcium and the zinc with the calcium concentration roughly five times that of the zinc. None of the standards studied using EXAFS contained zinc, suggesting that this sample may contain compounds not normally associated with calcifications.

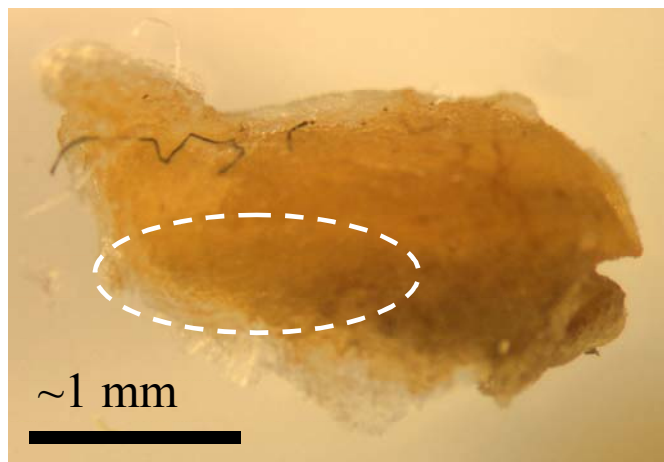


Figure 2. Photograph of one of the tissue samples. The dashed lines enclose the region of the calcification.

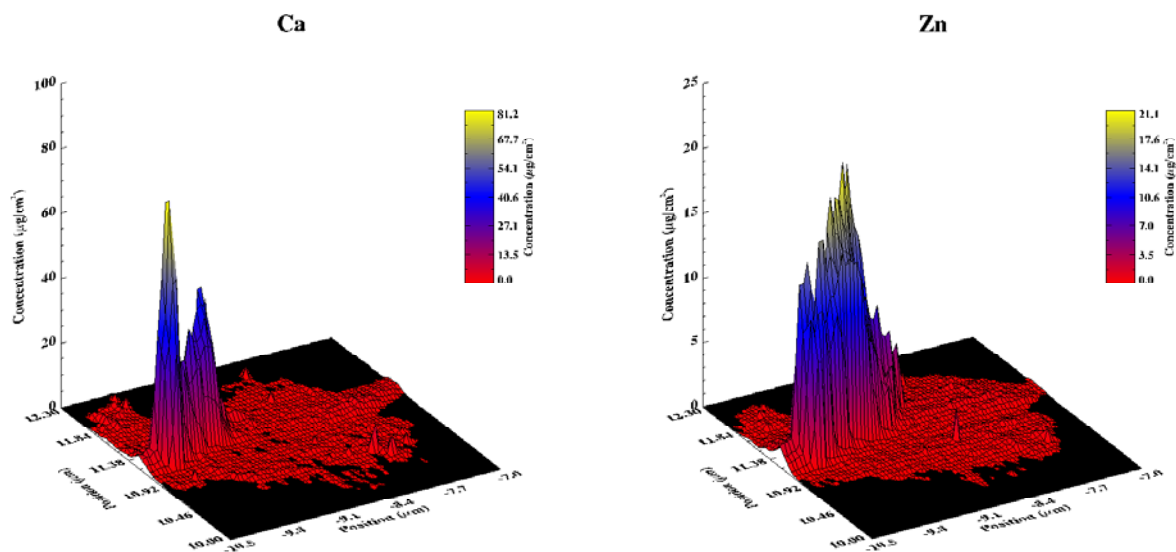


Figure 3. Concentration maps of a) Ca and b) Zn from the sample shown in figure 2.

#### References:

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2. M.J. Radi, *Arch. Pathol. Lab. Med.*, **113**, 1367 (1989).

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